

CLAIMS

What is claimed is:

1. A magnetic memory comprising:

a plurality of magnetic memory cells, each of the plurality of magnetic memory cells
5 including a magnetic element having a data storage layer that stores data magnetically;

at least one magnetic write line coupled with the plurality of magnetic memory cells,
the at least one magnetic write line being magnetostatically coupled with at least the data
storage layer of the magnetic element of each of the plurality of magnetic memory cells such
that flux closure is substantially achieved for the data storage layer of each of the plurality of
10 magnetic memory cells.

2. The magnetic memory of claim 1 wherein the magnetic element is a magnetic
tunneling junction including a pinned layer, a free layer and an insulating layer between the
pinned layer and the free layer, the free layer being the data storage layer.

3. The magnetic memory of claim 2 wherein the magnetic tunneling junction
further includes a capping layer between the free layer and the at least one magnetic write
line, the capping layer being configured to preclude an exchange coupling between the free
layer and the at least one magnetic write line.

4. The magnetic memory of claim 3 wherein the magnetic tunneling junction

further includes a soft magnetic layer disposed between the capping layer and the at least one magnetic write line.

5 5. The magnetic memory of claim 2 wherein the magnetic tunneling junction further includes at least one additional layer including an antiferromagnetic layer, the antiferromagnetic layer being magnetically coupled to the pinned layer.

10 6. The magnetic memory of claim 1 wherein the data storage layer has a first easy axis and the at least one magnetic write line has a second easy axis, the first easy axis being substantially perpendicular to the second easy axis.

15 7. The magnetic memory of claim 1 wherein the at least one magnetic write line includes a nonmagnetic layer and a soft magnetic layer, the nonmagnetic layer residing between the soft magnetic layer and the magnetic element of each of the plurality of magnetic storage cells.

20 8. The magnetic memory of claim 7 wherein the at least one magnetic write line further includes a conductive layer, the soft magnetic layer residing between the conductive layer and the nonmagnetic layer.

 9. The magnetic memory of claim 8 wherein the conductive layer is configured

to ensure that the at least one magnetic write line has a desired resistance.

10. The magnetic memory of claim 1 wherein the at least one magnetic write line includes a nonmagnetic layer and a plurality of soft magnetic structures, the plurality of soft magnetic structures being disposed directly above the plurality of magnetic memory cells, the nonmagnetic layer being disposed between the plurality of soft magnetic structures and the plurality of magnetic memory cells.

11. The magnetic memory of claim 10 wherein the nonmagnetic layer includes a plurality of recesses therein, at least a portion of each of the plurality of soft magnetic structures residing in each of the plurality of recesses.

12. A method for utilizing a magnetic memory comprising the steps of:

(a) in a write mode, writing to a first portion of a plurality of magnetic memory cells, each of the plurality of magnetic memory cells including a magnetic element having a data storage layer that stores data magnetically, the plurality of magnetic memory cells being coupled with at least one magnetic write line, the at least one magnetic write line being magnetostatically coupled with at least the data storage layer of the magnetic element of each of the plurality of magnetic memory cells such that flux closure is substantially achieved for the data storage layer of each of the plurality of magnetic memory cells; and

(b) in a read mode, reading from a second portion of the plurality of magnetic

memory cells.

13. A method for providing a magnetic memory comprising:

(a) providing a plurality of magnetic memory cells, each of the plurality of
5 magnetic memory cells including a magnetic element having a data storage layer that stores
data magnetically;

(b) providing at least one magnetic write line coupled with the plurality of
magnetic memory cells, the at least one magnetic write line being magnetostatically coupled
with at least the data storage layer of the magnetic element of each of the plurality of
10 magnetic memory cells such that flux closure is substantially achieved for the data storage
layer of each of the plurality of magnetic memory cells.

14. The method of claim 13 wherein the magnetic memory cell providing step (a)
further includes the step of:

15 (a1) providing a magnetic tunneling junction as the magnetic element, the
magnetic tunneling junction including a pinned layer, a free layer and an insulating layer
between the pinned layer and the free layer, the free layer being the data storage layer.

20 15. The method of claim 13 wherein the magnetic tunneling junction providing
step (a1) further includes the step of:

(a1i) providing a capping layer between the free layer and the at least one magnetic

write line, the capping layer being configured to preclude an exchange coupling between the free layer and the at least one magnetic write line.

16. The method of claim 15 wherein the magnetic tunneling junction providing
5 step (a1) further includes the step of:

(a1ii) providing a soft magnetic layer disposed between the capping layer and the at least one magnetic write line.

17. The method of claim 14 wherein the magnetic tunneling junction providing
10 step (a1) further includes the step of:

(a1i) providing at least one additional layer including an antiferromagnetic layer, the antiferromagnetic layer being magnetically coupled to the pinned layer.

18. The method of claim 13 wherein the data storage layer has a first easy axis
15 and the at least one magnetic write line has a second easy axis, the first easy axis being substantially perpendicular to the second easy axis.

19. The method of claim 13 wherein the at least one magnetic write line providing step (b) further includes the step of:

20 (b1) providing a nonmagnetic layer; and

(b2) providing a soft magnetic layer, the nonmagnetic layer residing between the soft magnetic layer and the magnetic element of each of the plurality of magnetic storage cells.

5 20. The method of claim 19 wherein the at least one magnetic write line providing step (b) further includes the step of:

(b3) providing a conductive layer, the soft magnetic layer residing between the conductive layer and the nonmagnetic layer.

10 21. The method of claim 20 wherein the conductive layer is configured to ensure that the at least one magnetic write line has a desired resistance.

22. The method of claim 13 wherein the step of providing the at least one magnetic write line further includes the step of:

15 (b1) providing a nonmagnetic layer; and

(b2) providing a plurality of soft magnetic structures, the plurality of soft magnetic structures being disposed directly above the plurality of magnetic memory cells, the nonmagnetic layer being disposed between the plurality of soft magnetic structures and the plurality of magnetic memory cells.

20

23. The method of claim 22 wherein the nonmagnetic layer providing step further includes the step of:

(b1i) providing a plurality of recesses in the nonmagnetic layer, at least a portion of each of the plurality of soft magnetic structures residing in each of the plurality of recesses.